Comparisons between bovine maternal and fetal hepatic mineral content

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Understanding nutrition's role in animal health has prompted a need for accurate assessment and interpretation of mineral status relative to disease potential. Adult animal tissue mineral concentrations and their interpretation have been well defined. Diagnostic criteria for fetal hepatic mineral concentrations are not well established. The aim of this study was to generate preliminary data for assessing bovine fetal hepatic mineral concentrations.

Liver samples were collected from 181 pairs of pregnant cows and their fetuses at an abattoir over a period of 13 months. Breed, sex, fetal numbers and measured crown-rump length were recorded at time of collection. Inductively coupled plasma atomic emission spectroscopy (ICP/MS) was used to assay 9 minerals (calcium [Ca], copper [Cu], cobalt [Co], iron [Fe], magnesium [Mg], manganese [Mn], molybdenum [Mo], selenium [Se], zinc [Zn]) in all samples. Mineral concentrations were determined on a wet weight (WW) and converted to a dry weight (DW) basis. Liver dry matter (DM) content was determined by drying an aliquot sample in a convection oven. Fetal gestational age was estimated from measured crown-rump length. Population statistics were determined for fetal and maternal mineral values. Regression and ANOVA were used to evaluate interrelationships and breed effects between fetal and maternal hepatic mineral concentrations.

Paired fetal-maternal samples were collected from 142 dairy and 39 beef cows, including 11 sets of twins (10 dairy; 1 beef). Mean (range) fetal age was 6.4 (3.8-9.4 months). Raw hepatic mineral concentrations (WW and DW basis) across maternal and fetal samples spanned from very low to very high values relative to current reference information. Mineral supplementation rate and subclinical disease information were unavailable. No evidence of clinical disease was observed. Though fetal and maternal hepatic mineral content on a WW basis were statistically different, range of the raw values were very similar. Only fetal Fe (258.1 ppm) and Zn (169.4 ppm) showed greater ($P<.002$, .007) values across gestational age compared to maternal concentrations (87.0 ppm; 65.5 ppm), respectively. Wet weight value comparisons are confounded by differences in hepatic DM content and gestational age effects on fetal mineral concentrations. Hepatic DW mineral concentrations showed more distinct statistical differences between maternal and fetal values across gestation, though this was somewhat breed dependent. Fetal and maternal hepatic mineral concentrations are distinct populations requiring specific diagnostic criteria for interpretation. Interpretation of mineral WW concentrations is confounded by DM differences and changes over time and criteria based on DW values are recommended.